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MACHINE LEARNING AND DATA-DRIVEN INNOVATIONS IN AERODYNAMIC OPTIMIZATION AND UNCERTAINTY QUANTIFICATION

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Abstract of the session

In recent years, the surge in data from computational sciences has underscored its potential to deliver insights and enhance predictive capabilities. In aerodynamics, extensive studies and optimizations yield large volumes of valuable data, creating an opportunity to advance data-driven and data-fusion models in engineering [1]. Yet, the integration of these models is still developing, with best practices only beginning to form.

Machine learning, including neural networks, offers a robust toolkit for tasks like clustering, dimensionality reduction, classification, and regression. However, processing and preparing aerodynamic and geometric data poses notable challenges. These tasks are often complex and objective-specific, leading to varied interpretations and applications of data-driven methods. Integrating machine learning techniques, commonly used in AI and Data Mining, promises substantial reductions in computational costs for aerodynamic analysis and uncertainty quantification [2]. These advanced methods open a pathway toward efficient, accurate solutions in aerodynamic design, despite ongoing challenges in data handling and model maturity.

This minisymposium aims to showcase new approaches and recent progress in applying machine learning and data-driven techniques for aerodynamic analysis and uncertainty quantification, with a focus on practical challenges and on the new opportunities that Scientific Machine Learning, i.e. the fusion of advanced Machine Learning techniques with Scientific Computing, offers for the development of increasingly efficient and effective analysis and design methodologies.

REFERENCES

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